



Science of Science Policy: STAR METRICS Project

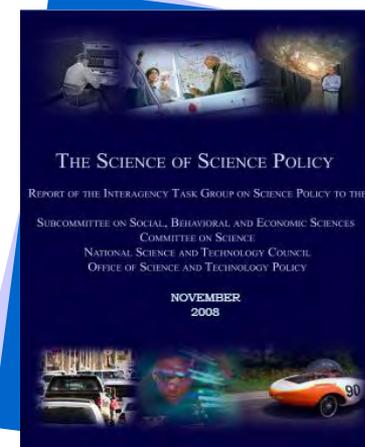
Julia Lane/OSTP, NSF and NIH





The Science of Science Policy Roadmap

- **Science of Science Policy Interagency Task Group:
Committee on Science, National Science and Technology
Council**
 - Participating Agencies: DoE, NSF, CDC, CIA, DoC, DoD, EPA, NASA, NOAA, NIST, OSTP, OMB, USDA, USGS, VA
- **Published in November, 2008**
 - Four guiding themes
 - Ten key questions





Feedback to Roadmap/Input on SoSP Goals:

- **Feedback from the 2008 SoSP Workshop: shaped interagency research priorities for SOSP:**
 - Developing a Data Infrastructure for Science and Innovation Policy
 - Modeling
 - Creating an Innovation Framework
 - Informing and Assessing R&D Investments
 - Conducting Outreach to Underrepresented Populations
- **Feedback from 2009 SoSP Workshop: Best Practices in Research and Development Prioritization, Management, and Evaluation**
 - Building community of practice
 - Focus on link to research coming out of NSF SciSIP program





Aligned with Presidential Priorities

■ Investment in Science

- American Recovery and Reinvestment Act
- The National Academy of Sciences Speech, April 2009

■ Openness and transparency

- data.gov; open.gov; etc.

■ Evidence based policy

- Joint memo on “Science and Technology Priorities for the FY2011 Budget” :
Science of Science Policy (is the only program listed by name)

■ Accountability

- ARRA Reporting Guidelines
- Putting Performance First: Replacing PART with a new performance improvement and analysis framework





STAR Pilot: Baseline Assumptions

- **Need to start with correct unit of analysis**
 - Science is done by scientists: Need to identify universe of individuals funded by federal funds (PIs, co-PIs, RAs, graduate students, technicians, subcontractors, etc.)
- **Include broad description of input measures**
- **Include broad description of outcomes**
- **Combine inputs and outcomes**
- **Create appropriate metrics that capture as many dimensions of science investments as possible**





STAR Pilot: Guiding Principles

■ Operational

- Minimum burden: Leverage existing information at academic institutions and agencies; do not interfere with existing systems
- Minimum cost: Leverage existing investments in administrative records, patent, and citation data
- Full confidentiality protections: Best practices

■ Analytical

- Utilize existing investments in data: Statistics of Income, Webscraping; Visualization
- Create open and transparent approach to knowledge creation: Collaboratory



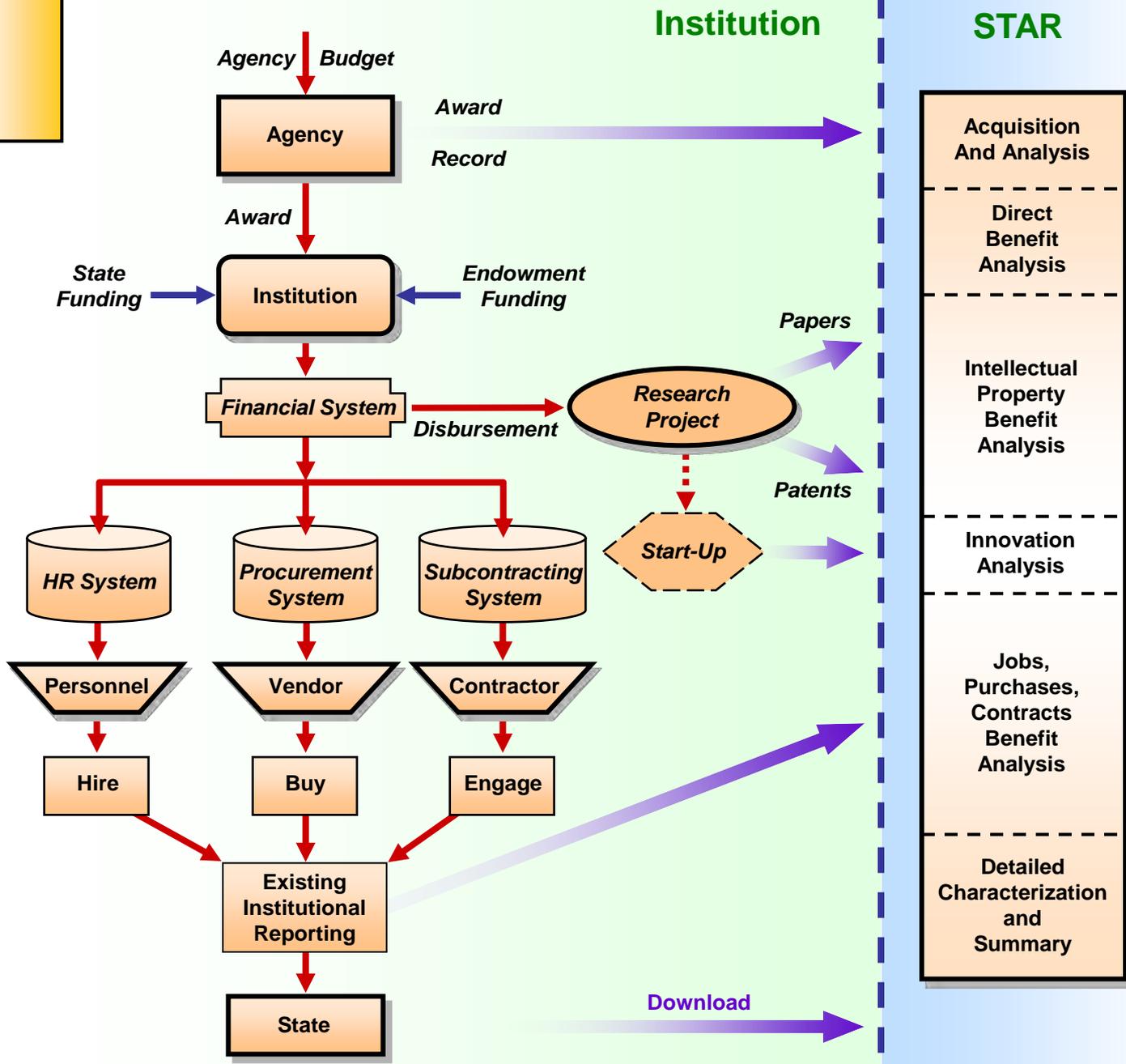


Current Context: ARRA Reporting

- **Automatically generate job creation measures**
 - Create administrative tracking system
 - Existing payroll management systems
 - Unemployment insurance wage records
 - External validation and accountability
 - Credible researchers
 - External tagging
- **Evidence-based, full-impact metrics**
 - Short term: Initial direct and indirect job creation impact



STAR Pilot Project





STAR Pilot: Actions

- **Partnered with FDP Institutions**
 - Asked for administrative records
 - Asked for assistance in development of metrics
- **Seven Institutions were site-visited**
 - Delaware, Pennsylvania, George Mason, Texas (Austin), Alabama (Tuscaloosa), CalTech, Massachusetts





STAR Pilot: Preliminary Data on Grant Recipients





Preliminary Findings and Feedback

- **Partnered with FDP Institutions**
 - Asked for administrative records
 - Asked for assistance in development of metrics
- **Identification of systemic and idiosyncratic data issues**
 - Relatively clean data
 - Anomalies exist that will need to be coded up in next stage
- **Response of pilot universities**
 - Doable
 - Very supportive, enthusiasm for approach
- **Briefed VP Office**
 - Approval on STAR pilot approach, timeline
 - Approach is aligned with the ARRA Section 1512 guidance, which calls for recipients to use payroll and finance data in calculation of estimates





STAR Pilot: Final Steps

- **Mapping to standardized occupational categories**
 - Teaching faculty, research faculty; postdocs; grad students; undergrad students; tech support; administrative support
- **Four universities have sent historical employment records**
 - Caltech; GMU; UT Austin; UA Tuscaloosa
- **Report on indirect costs to cognizant agencies**
 - Allocation of overhead to labor costs
- **Standardization of report format**





Next Steps: STAR METRICS¹

- **Interagency effort led by OSTP and Science Agencies**
- **Continue partnering with FDP**
 - Reporting initial findings January 2010 meeting
 - Soliciting participation of broader FDP membership
 - Report to OSTP in March 2010
- **Coordinating Federal agencies**
 - OSTP, NIH, and NSF have drafted MOU to build beta data infrastructure matched to patent, citations, publications datasets
 - MOU open for other agencies to join as they are ready

¹ Science and Technology in America's Reinvestment – Measuring the Effect of Research on Innovation, Competitiveness and Science





Initial Results: Example of University XX

year_month		2009-11		Values							
sponsor	sponsor_class	Stimulus Funds	# INSTITUTION EMP IDs	% of INSTITUTION EMP IDs	# FTE equivalents (based on FTE factor)	% of FTE equivalents (based on FTE factor)	Total Payroll Amount	% of Total Payroll	Est. # of Jobs Created (from prior month)	% of Est. Jobs Created	
<input type="checkbox"/> Federal Agency			1,052	50.6%	613.1	46.0%	\$362,880	42.3%	391.5	57.8%	
	<input type="checkbox"/> Federal Non-Science Agency		653	31.4%	346.4	26.0%	\$253,535	29.5%	179.6	26.5%	
		N	228	11.0%	182.5	13.7%	\$87,688	10.2%	158.8	23.4%	
		Y	425	20.4%	163.9	12.3%	\$165,847	19.3%	20.8	3.1%	
	<input type="checkbox"/> Federal Science Agency		399	19.2%	266.6	20.0%	\$109,345	12.7%	211.9	31.3%	
		N	355	17.1%	240.3	18.0%	\$102,573	11.9%	195.8	28.9%	
		Y	44	2.1%	26.4	2.0%	\$6,773	0.8%	16.1	2.4%	
<input type="checkbox"/> Non-Federal			1,029	49.4%	720.0	54.0%	\$495,766	57.7%	286.2	42.2%	
	<input type="checkbox"/> Non-Federal		1,029	49.4%	720.0	54.0%	\$495,766	57.7%	286.2	42.2%	
		N	1,029	49.4%	720.0	54.0%	\$495,766	57.7%	286.2	42.2%	
Grand Total			2,081	100.0%	1,333.1	100.0%	\$858,647	100.0%	677.6	100.0%	





Impact of Spending by Occupation

year_month	2009-11								
Values									
Row Labels	# INSTITUTION EMP IDs	INSTITUTION EMP IDs	# FTE (based on FTE factor)	% of FTE equivalents (based on FTE factor)	Total Payroll Amount	% of Total Payroll	Est. # of Jobs Created (from prior month)	% of Est. Jobs Created	
Federal Agency	1,052	100.0%	613.1	100.0%	\$362,880	100.0%	391.5	100.0%	
Federal Non-Science Agency	653	62.1%	346.4	56.5%	\$253,535	69.9%	179.6	45.9%	
Exec/Admin/Mgr General	1	0.1%	1.0	0.2%	\$0	0.0%	1.0	0.3%	
Faculty Administration Increment	1	0.1%	0.1	0.0%	\$1,000	0.3%	0.1	0.0%	
Faculty Instruction	6	0.6%	4.6	0.7%	\$1,418	0.4%	4.6	1.2%	
Faculty Research	12	1.1%	12.0	2.0%	\$5,536	1.5%	12.0	3.1%	
Faculty Research - Summer	1	0.1%	0.9	0.2%	\$0	0.0%	0.9	0.2%	
Faculty Supplemental Comp	1	0.1%	0.5	0.1%	\$150	0.0%	0.0	0.0%	
Graduate Research Assistant	70	6.7%	32.3	5.3%	\$32,366	8.9%	13.2	3.4%	
Graduate Student Assistant	5	0.5%	2.0	0.3%	\$3,675	1.0%	1.0	0.3%	
Maintenance - General	3	0.3%	1.6	0.3%	\$0	0.0%	0.0	0.0%	
Professional (Not exempt)	2	0.2%	1.5	0.2%	\$1,338	0.4%	1.5	0.4%	
Professional (Exempt)	90	8.6%	89.1	14.5%	\$37,813	10.4%	81.8	20.9%	
Secretarial/Clerical - General	46	4.4%	45.0	7.3%	\$25,114	6.9%	42.5	10.9%	
Undergraduate Student Assistant	415	39.4%	155.9	25.4%	\$145,125	40.0%	21.0	5.4%	
Federal Science Agency	399	37.9%	266.6	43.5%	\$109,345	30.1%	211.9	54.1%	
Faculty Instruction	6	0.6%	6.0	1.0%	\$483	0.1%	6.0	1.5%	
Faculty Research	34	3.2%	32.6	5.3%	\$8,070	2.2%	32.6	8.3%	
Faculty Research - Summer	4	0.4%	3.0	0.5%	\$200	0.1%	2.0	0.5%	
Graduate Research Assistant	130	12.4%	58.4	9.5%	\$16,567	4.6%	32.4	8.3%	
Graduate Student Assistant	4	0.4%	2.0	0.3%	\$565	0.2%	0.5	0.1%	
Maintenance - General	2	0.2%	0.7	0.1%	\$875	0.2%	0.2	0.1%	
Professional (Not exempt)	3	0.3%	3.0	0.5%	\$2,239	0.6%	3.0	0.8%	
Professional (Exempt)	108	10.3%	105.8	17.3%	\$34,557	9.5%	96.1	24.5%	
Secretarial/Clerical - General	43	4.1%	33.0	5.4%	\$27,538	7.6%	25.5	6.5%	
Undergraduate Student Assistant	65	6.2%	22.2	3.6%	\$18,251	5.0%	13.6	3.5%	
Grand Total	1,052	100.0%	613.1	100.0%	\$362,880	100.0%	391.5	100.0%	



STAR METRICS: Building the framework

- **Framework: A collection of integrated databases**
 - Agency records transmitted on a flow basis
 - University records transmitted on a flow basis
- **Reduce Burden on PI's and Universities**
 - Automated webscraping and reporting of outcomes to agencies, state legislatures and other constituencies
 - Systematized, standardized and validated ongoing measurement of long term outcomes and impact of science investments
 - Economic outcomes: Patents, patent applications, new businesses
 - Scientific outcomes: Creation and uptake of ideas, knowledge diffusion, e.g. citations, new fields
 - Social outcomes: Health, welfare, environment





Dropin Code: Peoplesoft

```
SELECT A.CONTRACT_NUM, A.PROJECT_ID,  
A.UM_AWARD_PI, A.UM_SPONSOR_NAME, A.CFDA,  
A.SPNSR_TYPE, A.REF_AWD_NUMBER,  
A.UM_PROJECT_DESCR, TO_CHAR(A.START_DT,'YYYY-MM-  
DD'), TO_CHAR(A.END_DT,'YYYY-MM-DD'), A.FUNDED_AMT  
FROM PS_UM_PRJGM_ATT_VW A, PS_GM_PRJ_DEPT B  
WHERE A.BUSINESS_UNIT = 'UMDAR'  
AND B.BUSINESS_UNIT = A.BUSINESS_UNIT  
AND B.PROJECT_ID = A.PROJECT_ID
```





Sample Output

UMD Award Number	UMD Project Number	HR Dept Number	Award PI	Sponsor Name	CFDA
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000000000000006	S33000000004641	104888	Jochim, Lisa A.	MASSACHUSETTS DEPARTMENT OF EDUCATION	
000000000000014	S32100000004650	105102	Xu, Haiping	NATIONAL SCIENCE FOUNDATION	47.070

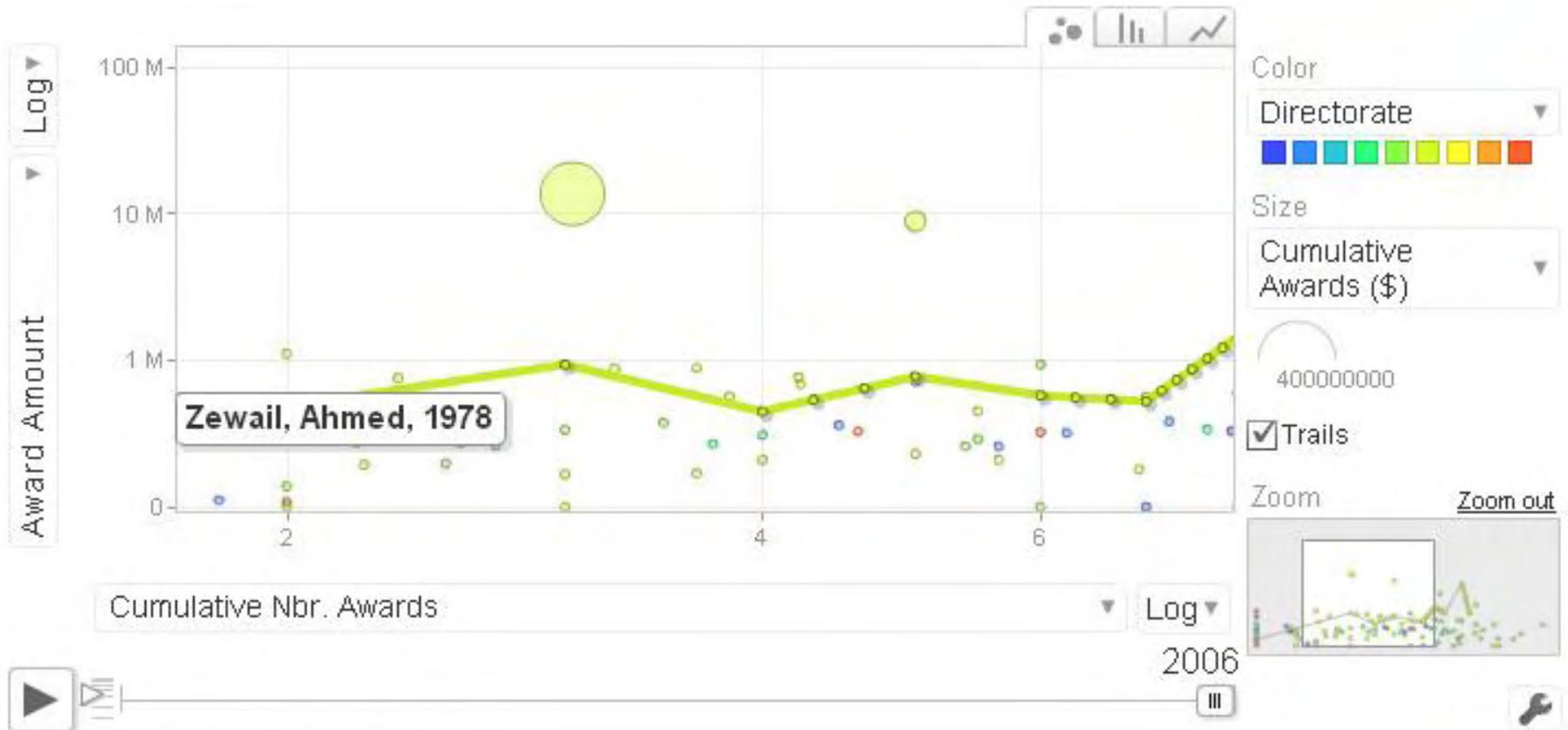
Type	Ref Awd #	Project Descr	Start Date	End Date	Funded Amt
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STMA	345-090-7-1255-H	Worker's Education Program	1/18/2007	6/30/2007	100091.00
FEDR	CNS-0715648	Collaborative Research: Agent-	8/1/2007	7/31/2010	120000.00





Sample Output for FDP: Google Motion Graph



Demonstration of CalTech data visualization: <http://sites.google.com/site/synthosys/home/google-motion-chart>





Science Agency and University Partnership

- **Current**
 - OSTP and major science agency led initiative
 - Actual, administratively based, externally verifiable, measures of job creation for pilot universities
 - Expanding to additional universities
- **University faculty are invited to participate in matching exercise with citations, patents, patent applications and other economic/scientific/social outcome metrics**
 - Report to OSTP and participating agencies scheduled for March 2010





STAR METRICS: Ultimate Goals

- Fully fledged academic field
- Fully fledged analytical tool set in government
 - Science policy in same analytical tier as tax policy
- Common empirical infrastructure available to all universities and science agencies to quickly respond to State, Congressional and OMB requests
- Common scientific infrastructure for researchers to develop and study science policy





External Databases

- Patents
- Citations
- Firm startups

University Database

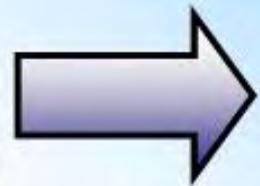
- Graduate students
- Undergraduates
- Support Personnel

Data Repository

- STATA
- SAS

Agency Data

- Grant Awards
- Institution
- PI & Co-PI information



Analytical Output and Metrics

